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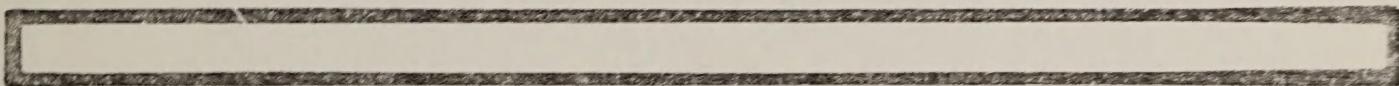
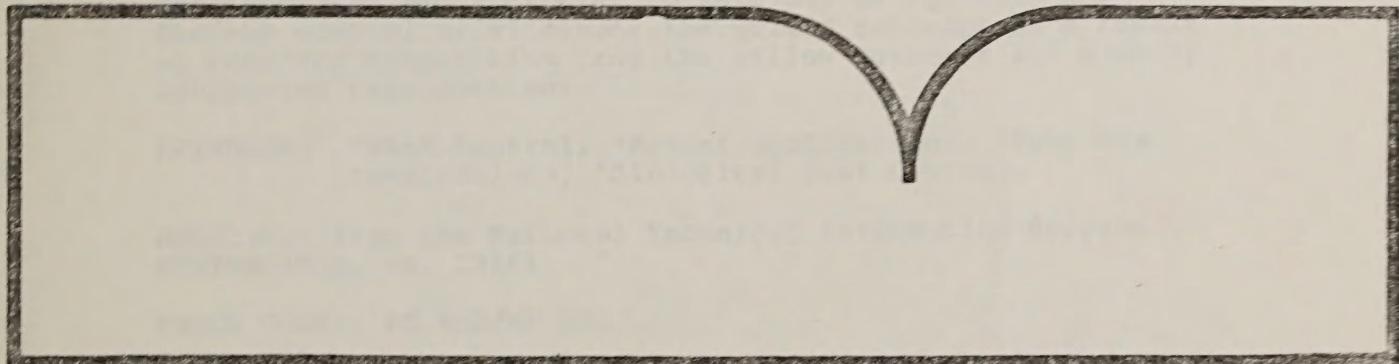
Method for Controlling  
Yellow Nutsedge Using  
'Puccinia canaliculata'

(U.S.) Department of Agriculture, Washington, DC

20 Sep 85

JIN 8-1988

CATALOGING-PREP





BIBLIOGRAPHIC INFORMATION

PB86-141843

Method for Controlling Yellow Nutsedge Using 'Puccinia  
canaliculata'.

Filed 20 Sep 85

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PERFORMER: Department of Agriculture, Washington, DC.  
PAT-APPL-6-788 048

This Government-owned invention available for U.S. licensing  
and, possibly, for foreign licensing. Copy of application  
available NTIS.

The invention provides a process for controlling or  
eliminating yellow nutsedge in the agricultural field, and  
comprises inoculating the agricultural field that is  
contaminated with yellow nutsedge with a sufficient amount  
of an effective strain of the rust fungus *Puccinia*  
*canaliculata*, and a carrier to initiate an epidemic and  
thereby control or eliminate the yellow nutsedge as a result  
of reducing competition from the yellow nutsedge and also by  
inhibiting reproduction.

KEYWORDS: \*Weed control, \*Patent applications, \**Puccinia*  
*canaliculata*, \*Biological pest control.

Available from the National Technical Information Service,  
SPRINGFIELD, VA. 22161

PRICE CODE: PC A02/MF A01



This is a CIP OF PC 6922-SR  
 Serial No. 591,367  
 Filed March 20, 1984

PC 6946-SR

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 Serial No. 778,048  
 Filed September 20, 1985

METHOD FOR CONTROLLING YELLOW NUTSEDGE  
 USING PUCCINIA CANALICULATA

CROSS-REFERENCE TO RELATED APPLICATIONS

5 This is a continuation-in-part of Application Serial  
 No. 591,367, filed March 20, 1984.

BACKGROUND OF THE INVENTION

1) Field of the Invention

This invention relates to a method of controlling yellow  
 10 nutsedge using the rust fungus.

2) Description of the Prior Art

15 Yellow nutsedge, *Cyperus esculentus L.*, is thought to  
 be one of the world's most troublesome weeds. This weed has  
 been a serious pest for many decades. In recent years it  
 has spread rapidly throughout the United States and is now  
 the most troublesome perennial weed in most of the Midwest.

20 Yellow nutsedge reproduces prolifically. One tuber  
 plated in a field in Minnesota produced 1900 plants and 6900  
 tubers in 1 year. In Georgia 622 tubers were produced from  
 one tuber in 17 weeks.

In spite of considerable effort, biocontrol methods for  
 yellow nutsedge have not shown much success. Rust caused  
 by *Puccinia Canaliculata* was first described in 1832. In  
 1906, it was demonstrated that *Xanthium sp.* was an alternate



host, and indication that the pathogen is a macrocyclic heteroecious rust. Another possible alternate host is giant ragweed, *Ambrosia trifida L.* To our knowledge, no research has been reported on using this rust fungus to control yellow nutsedge. Researchers have observed the rust on yellow nutsedge in many locations in the United States and Canada. However, it usually does not appear until August and does not increase substantially until September. By then, the nutsedge has produced new seed and tubers and its life cycle is unaffected by the rust.

#### SUMMARY OF THE INVENTION

This invention provides a process for controlling or eliminating yellow nutsedge in the agricultural field, and comprises inoculating the agricultural field that is contaminated with yellow nutsedge with a sufficient amount of an effective strain of the rust fungus *Puccinia canaliculata*, and a carrier to initiate an epidemic and thereby control or eliminate the yellow nutsedge as a result of reducing competition from the yellow nutsedge and also by inhibiting reproduction.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

*Puccinia canaliculata* is on deposit as *Puccinia canaliculata* ATCC (#40199) at the following location: American Type Culture Collection, 12301 Parklawn Drive, Rockville, MD 20852. Documentation of the organism *Puccinia canaliculata* can be found in J. C. Arthur, Manual of the Rusts in the United States and Canada (Purdue Research Foundation, Lafayette, Ind., 1934, page 180).

Earliest experimentation of effectiveness of controlling yellow



nutsedge with the rust fungus *Puccinia canaliculata* was conducted after an epiphytic of rust was observed on a dense strand of yellow nutsedge in September 1978 on applicant's research farm near Tifton, Georgia. Later in August-September, 1979 a severe rust epiphytic developed on this nutsedge. In 1980, weekly observations were carried out and found a few plants in June with rust. The infected nutsedge was located in vegetable research plots that had been sprayed weekly with fungicides. The infected plants were then potted and placed among a thick stand of yellow nutsedge (0.5ha) without any symptoms 7 Km away. The new area was not sprayed with fungicides. Rust pustules were evident on plants at the new site within 12 days. An epiphytic developed within 4 weeks over the entire area. This early experiment indicated that yellow nutsedge could be controlled to some extent using the fungus.

EXAMPLE 1

The following experiment was carried out to conclusively show the effectiveness of using the rust fungus *Puccinia canaliculata* to control yellow nutsedge:

Rust was maintained on infected plants in a green house during the winter months. Pots of nutsedge plants with only one to two visible rust pustules were placed in



four plots (13 x 13m) on May 1, 1981 as soon as nutsedge  
appeared in the plots. Within 10 days pustules were  
observed on all nutsedge plants within 1m of the original  
plants and within 7m in 14 days. There was no visible  
5 infection for up to 17 days on the windward side. The  
major direction of spread was eastward, an indication of  
leeward spore movement. Twenty-eight days later rust was  
observed 130m away on the leeward side of the original  
inoculum. By the first week of June, an epiphytotic  
10 developed with over 90 percent of the nutsedge leaves dead  
or dying. During this period, rust released in yellow  
nutsedge under a corn canopy moved only 3m. This result  
demonstrates that wind is essential for the spread of rust.  
Later, manual spraying of the rust was conducted to im-  
15 prove speed of spreading and control of inoculation.

Weekly observations indicated that dehydration of  
nutsedge root occurs soon after a few pustules appear on  
the plant. General dehydration of the plant follows root  
dehydration; this is reflected in a higher percentage of  
20 dry matter in rust-infected plants. (Table 1).



TABLE 1

Effect of rust fungus on nutsedge 60 days after rust release. Each mean is the average of four replications. In all cases listed, the means in each column were different at the 5 percent level (t-test).

Nutsedge Sample	Leaf Area Diseased (%)	Root Growth (%)	Fresh Weight Per Plant (g)	Dry Weight Per Plant (g)	Dry Matter (%)
Rust-Infected	78.5	18.5	5.9	1.8	29.8
Control*	10.5	87.0	13.7	2.9	21.1

5

\*Weekly application of chlorothalonil.



Old parent tubers on infected plants were also dehydrated. Rust reduced the dry weight and fresh weight of nutsedge. (See Table 1 Supra). Flowering and tuber formation of nutsedge were inhibited in rust-infected areas for up to 16 weeks after inoculation, whereas chlorothalonil-sprayed nutsedge controls flowered profusely and produced tubers. (See Table 2).

TABLE 2

Effect of rust fungus on nutsedge tuber formation, flowering, and survival 90 and 120 days after rust release. The numbers in parentheses represent the percentages of the totals. Each mean is the average of four replications. Each pair of rust-control means is different at the 5 percent level (t-test).

Nutsedge	Number per 0.93m <sup>2</sup>			
	90 Days		120 Days	
	Rust Infected	Control*	Rust Infected	Control*
<b>Tubers</b>				
Old	169	132	167	108
New	17(9)	60(31)	16(9)	63(37)
<b>Plants</b>				
Live	112	201	144	313
Dead	91(45)	4(2)	122(46)	6(2)
<b>Inflorescences</b>	0	23	0	83

\*Weekly application chlorothalonil.



5                   Rapid dehydration and substantial reduction or  
elimination of normal vegetative and sexual reproductive  
processes, even with moderate rust infection, suggests  
the production of a biologically active substance or  
substances.

The rust may be applied by wind-carried particles,  
granularly applied, sprayed, irrigation, air dropped or  
from pesticide delivery systems.

10                  The rust is adapted to a wide range of climatic con-  
ditions. Rust epiphytic developed over several hectares  
from a series of releases throughout the growing season  
under all conditions where nutsedge was growing. The  
reported range of this rust is from Massachusetts to  
Nebraska, southward to Florida and west to California; it  
15                  is also found in Mexico, Central and South America, the  
West Indies, and Hawaii.

Puccinia canaliculata is specific on the genus Cyperus. It  
has been reported only on a number of weeds belonging to  
the genus Cyperus including yellow and purple nutsedge.

20                  (J. C. Arthur, Manual of the Rusts in the United States and  
Canada, Purdue Research Foundation, Lafayette, Indiana,  
(1934) p. 438). No rust was observed on



corn, soybean, peanut, tomato, pepper, okra, snap bean,  
lima bean, cucumber, squash, watermelon, southern pea,  
and cotton in the areas where yellow nutsedge surrounding  
5 these crops were covered with rust. Thus, this rust  
organism satisfies all the requirements for biological  
control agents outlined by: W. C. Shaw, *Weed Science*  
30 (Suppl.) 2 (1982).

10 In conclusion, the above experimental example given,  
clearly shows that the rust caused by *Fuccinia canaliculata*  
provides a valuable tool for the control of yellow nutsedge.



ABSTRACT OF THE DISCLOSURE

A biological method for either controlling or eliminating yellow nutsedge in agricultural fields is disclosed. An agricultural field which contains yellow nutsedge is  
5 inoculated with a sufficient amount of an effective strain of rust fungus *Puccinia canaliculata* and a carrier to an epidemic. As a result of reducing competition from the yellow nutsedge and inhibiting reproduction, the yellow nutsedge is either controlled or eliminated. Best results  
10 occur when the agricultural field is inoculated in the spring of the year. Application methods include: spraying, granular, irrigation, wind-carried, or air-dropped.



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